dopamine. The results indicate furthermore that no or very low β-hydroxylase activity is present in these mast-cells, since no increase in noradrenaline content was observed. Preliminary attempts to detect tertiary catecholamines have so far proved unsuccessful.

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Drugs affecting the behaviour and spontaneous bioelectrical activity of the central nervous system in the ant, *Formica rufa*

SIR,—Recently several reports on the influence of neuro- and psychotropic drugs on various species of invertebrates have been published (Witt, Brettschneider & Boris, 1961; Fange, 1962; Katona & Woleman, 1964; Mirolli & Welsh, 1964). The ant seems to be a suitable subject for such investigation because of the relatively high degree of development of the central nervous system and its well developed social behaviour.

We have investigated the effects of certain psychotropic drugs and neurohormones on behaviour and spontaneous bioelectrical activity recorded from the lobi optici of the ant, *Formica rufa*. The ants were kept in a plastic formicarium and were given the drugs orally in honey, or injected into the abdominal cavity, or applied locally to the exposed brain. The investigations included, observations of general behaviour, phototropic reaction and records of spontaneous bioelectrical activity of the lobi optici by tungsten wire electrodes, connected to a conventional EEG apparatus. The characteristic EEG pattern of the lobi optici of the ant, obtained in conditions of normal brightness consisted of 2-5 waves/sec and of amplitude from 5–50μ V. Of the drugs investigated the most marked in their effects were reserpine, chlorpromazine and strychnine.

Reserpine, 0·1–0·5 μg of body weight, given either orally or injected into the abdominal cavity, markedly inhibited the locomotor activity of the ant without causing ataxia or disturbances of co-ordination. Simultaneous outbursts of aggressiveness of a bizarre character were observed, ants from the same population after slight stimuli or even spontaneously attacking each other, a phenomenon never observed in the controls. The EEG pattern was slightly changed with transient slowing of frequency and increase of amplitude. The phototropic reaction was significantly suppressed (Fig. 1).

Reserpine given 12 hr after nialamide, 0·1 μg/g weight, caused similar inhibition of locomotor activity with outbursts of aggressive behaviour, but the phototropic reaction remained unchanged. Nialamide itself did not alter behaviour and EEG pattern. Chlorpromazine given orally or injected into the abdominal cavity (0·1–0·5 μg/g weight) inhibited locomotor activity causing severe disturbances of motor coordination and suppressed the phototropic reaction, but did not cause any mutual aggressiveness. The EEG record compared with that of the controls did not change. After lysergic acid diethylamide both general behaviour and the phototropic reaction were unaltered, but the EEG showed a slight decrease of amplitude and increase of frequency of the waves.

Neither chlordiazepoxide nor amphetamine changed the behaviour or the bioelectrical activity.

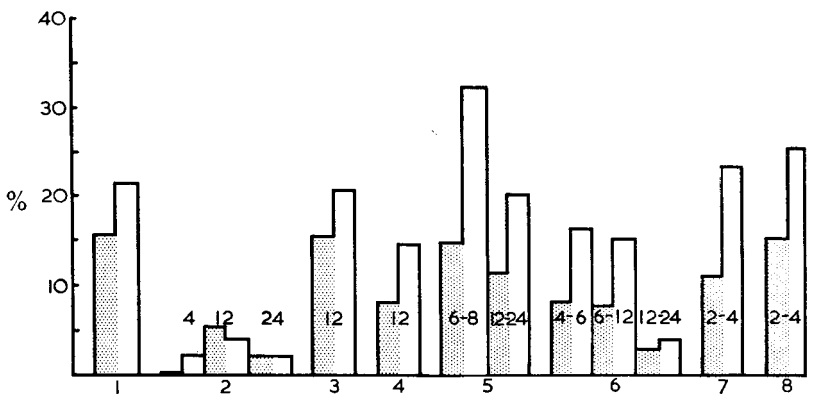

FIG. 1. Phototropic reaction of ants as a percentage of reacting insects. Shaded part of each column, percentage reacting after 5 min, and open part, after 10 min light exposure. Time (hr) after drug ingestion is marked on columns. The statistical significance of the difference between each group and control was estimated by χ^2 test. 1 = Control. 2 = Reserpine $P < 0{\cdot}005$. 3 = Nialamide $P > 0{\cdot}005$. 4 = Reserpine after nialamide $P > 0{\cdot}005$. 5 = Chlordiazepoxide $P > 0{\cdot}005$. 6 = Chlorpromazine $P > 0{\cdot}005$ (4-12 hr), $P < 0{\cdot}005$ (12-24 hr). 7 = Lysergic acid diethylamide $P > 0{\cdot}005$. 8 = Strychnine $P > 0{\cdot}005$.

Strychnine given orally in doses 0·1–0·2 μg/g weight, caused disturbances of locomotor activity, ataxia, and increased frequency and amplitude of waves in the EEG pattern. Acetylcholine, adrenaline, γ-aminobutyric acid and 5-hydroxytryptamine injected into abdominal cavity or applied locally on the exposed brain had little or no influence on bioelectrical activity of the ant brain. For instance, 5-HT caused a slight increase of amplitude and decrease of frequency of the EEG. None of the investigated neuro-hormones changed the behaviour of the ants.

The results obtained seem to indicate certain similarities between the effects of reserpine and chlorpromazine on the ant and laboratory animals. This may suggest that, despite the great differences between the subjects, the mode of action of reserpine and chlorpromazine may be similar in the different species.

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Acute toxicity of radiation-sterilised propylene glycol

SIR,—Certain drugs that are subject to hydrolysis when dispensed as an aqueous solution are prepared, for pharmaceutical purposes, as a solution in propylene glycol. Such solutions may be difficult to sterilise as many of the drugs concerned are affected by heating; bacteriological filtration is tedious due to the viscous nature of the solvent and there is always a risk that the aseptic precautions necessary for the filling and sealing of the final containers may fail. Radiation sterilisation may offer a useful alternative method: it can be applied to the preparation in its sealed container.

The present investigation was stimulated by the need to sterilise a solution of di-isopropylfluorophosphonate (dyflos, DFP) in propylene glycol (1 mg/ml). The dyflos is prepared with labelled phosphorus atoms (^{32}P) and the solution is intended for parenteral use in clinical studies of blood cell turnover. Preliminary studies indicated that the potency of the dyflos itself was only very slightly affected by radiation sterilisation (Charlton, personal communication) but no information was available on the effect of radiation sterilisation on the toxicity of propylene glycol.

A sample of redistilled propylene glycol was divided into two parts, one of which was irradiated with 2·5 Mrad of gamma radiation—the dose used for sterilisation of medical equipment (Burt & Ley, 1963).

Groups of 3 male and 3 female adult SPF albino rats were given either irradiated or unirradiated propylene glycol by intraperitoneal injection at the following doses: 9·4, 11·1, 13·0, 15·3, 18·0 and 21·1 ml/kg body weight. The LD50 values were calculated from the mortality after 5 days using the method of Finney (1952). The LD50 values, with the 95% fiducial limits were for the irradiated material 13·7 (12·5–15·1) and for the control material 14·2 (12·4–16·1) ml/kg weight; differences between groups are not significant.

Irradiated or unirradiated propylene glycol was given to groups of 5 male and 5 female mice (C3H strain) by intraperitoneal injection to a dose of 5 ml/kg weight. Before injection, 1 part of propylene glycol was diluted with 2 parts of normal saline. This dose is about half the median lethal dose in mice (Lampe & Easterday, 1953) but although all mice showed signs of intoxication (lack of co-ordination of movements followed by deep narcosis and, in a few cases, convulsions), no mice died within 7 days of injection. During the week after injection with propylene glycol no differences were observed in general health, weight changes, or food and water intake between the groups receiving irradiated or unirradiated material. All the mice were killed and examined 7 days after injection; apart from evidence of inflammation of the peritoneal cavity, presumably caused by the injection, no abnormalities were observed in mice of either group.

These results show that sterilisation of propylene glycol with a dose of 2·5 Mrad of gamma radiation does not increase its acute toxicity and this information may be of interest to others who may be contemplating radiation sterilisation of other pharmaceutical preparations formulated with propylene glycol.